

SCIENCE

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VANDALISM AMONG THE ANTIQUITIES OF YUCATAN AND CENTRAL AMERICA.

BY M. H. SAVILLE, ASSISTANT IN PEABODY MUSEUM, HARVARD UNIV., CAMBRIDGE, MASS.

THE ancient buildings and sculptures of Yucatan and Central America have within a few years been much damaged and disfigured by the indifference of the natives of those countries, and by the vanity of travellers, some of them unfortunately American, who paint their names in large characters on the sides of the buildings and carve them on the sculptures.

Briefly, I will enumerate a few instances that have come under my personal observation.

The magnificent "House of the Governor" in Uxmal, probably the grandest building now standing in Yucatan, is almost covered with names on the front and on the cemented walls inside. These names are painted in black, blue, and red, and the letters are in some cases twelve inches high, and here are to be seen the names of men who are widely known in the scientific world. The "House of the Dwarfs" in the same city has suffered in a like manner. Many of the sculptures which have fallen from the buildings in Uxmal have been wilfully broken, and I noticed particularly that two of the beautifully carved turtles from the "House of the Turtles" had been broken apparently by a machete.

The large face figured by Stephens in "Incidents of Travel in Yucatan," Vol. II., p. 434, is in a mound in the backyard of a shop in Izamal. This has been almost destroyed. The whole of the face between the eyes and the lower part of the chin is gone, and I was told that the stones thus obtained were used in repairing a fence. On the other side of this mound is the bas-relief in stucco discovered by Charney, and this is slowly crumbling away. The steps leading up to the top of the Great Pyramid are being thrown down; and many mounds in Yucatan are being destroyed at the present time to furnish building material. In fact, if a bee's nest should be found in one of the old buildings, the Indians would tear down part of the structure to get at the honey.

In Copan, when the Peabody Museum Honduras Expedition compared the condition of the "Idols" to-day, with the photographs taken by Mr. A. P. Maudslay seven years ago, it was found that during that time some of the very finest sculptures had been disfigured by blows from machetes and other instruments. The Stela given as a frontispiece in Stephens's "Incidents of Travel in Central America," Vol. I., has been much marred by some one who has broken off several ornaments and a beautiful medallion face from the northern side. One of the faces and several noses have been broken off from the sitting figures on the altar figured by Stephens in the same volume, opposite page 142. On some of the idols and altars names have been carved, notably on the back of the Stela figured opposite page 158 in Stephens, and a large fragment has been broken from the same Stela. While excavating in one of the chambers of the Main Structure we uncovered a beautiful hieroglyphic step, but before we had time to secure a photograph of it, some visitor improved the opportunity while no one was about to break off one of the letters.

In Quirigua a small statue, discovered by Maudslay and removed by him to a small house near the rancho of Quirigua, had the head and one of the arms broken from it during the interval between two visits. This statue was of the highest importance, as it very much resembled the celebrated "Chaac-mol" now in the Mexican Museum, but discovered by Le Plongeon at Chichen

Itza. One of the Stelæ at Quirigua has had a name carved on it quite recently; but the sculptures of this place are in a much better state of preservation than those of Copan owing to their being at some distance from the road, and being covered with a dense tropical growth; while those of Copan are within a mile of the village, and there was formerly a road over the Plaza Grande and among the idols. The burning of the bush, to clear the land for milpas, has also injured many of the sculptures owing to the cracking of the stones by the heat.

While in Nicaragua I learned that the sculptures on the Island of Zapatero in Lake Nicaragua have within a few years been much broken and disfigured. These were described by Squier in "Nicaragua, Its People, Scenery, Monuments, etc.," Vol. II.

As the governments of Mexico and the Central American republics are making little or no effort to preserve or care for the antiquities within their boundaries, it remains for the United States to do something to preserve these vanishing memorials of the past. The initiative has been taken by the Peabody Museum, Cambridge, which has been granted, for ten years, the care of the antiquities of Honduras. A wall has been built enclosing the principal remains in Copan, and a keeper been placed in charge with strict orders to allow nothing to be destroyed or carried away. Thus a strong effort is being made by the Peabody Museum to protect the wonderful carvings in stone of the ancient city of Copan.

ANCIENT JAPANESE CLOCKS.

BY FRANK D. SKEEL, A M., M D., NEW YORK.

THE ancient Japanese, in common with most Oriental nations, measured time by the position of the sun. Their day commenced and ended with sunrise. As Japan lies between the thirtieth and the forty-fifth parallels of latitude, the days and nights vary considerably in length during the year. To fulfil the conditions of their notation a timepiece must divide into equal parts the periods of daylight and the periods of darkness. To construct a timepiece which will perform this erratic division of time is a mechanical problem of no mean order. This, the ancient Japanese have accomplished in several very ingenious ways.

Their clocks may be roughly divided into two general classes:—

1. Those with a constant rate, in which the changing length of the hours is indicated by the spacing of the numerals, which are engraved on movable pieces of metal.

2. Those with a varying rate, having the numerals equally spaced, the length of the hour being regulated by the rate of the clock.

Under the first division there are two types, namely, clocks with rectilinear dials, and clocks with circular dials. Clocks of the former type are driven by a weight or a spring. Those of the second type by weight only. The power is transmitted by a cord or chain to which, in clocks with rectilinear dials, the index is attached. The hour-signs are engraved on separate pieces of metal, which slide in a vertical groove in the front of the case. Parallel to this is a slit in the case, through which the hand is attached to the cord. The hours of day and of night are indicated by different characters. The spaces between these signs are regulated by moving the pieces of metal bearing the hour-signs nearer together or farther apart as occasion may require. Some clocks of this type are provided with graduations and a table by which the hour-signs may be properly adjusted in accordance with the season of the year. The hand moves downward over the face of the dial as the clock runs down and resumes its place at the top when it is wound. The escapement is the verge, with crown-wheel, balance-wheel, and hairspring. The driving-power is either a weight or a spring, as before stated.

In some weight-clocks the striking-train and bell comprise the driving-weight. The striking mechanism is released by pins projecting from the back of the little plates carrying the hour-signs. These pins trip a small lever as the train passes. Clocks drawn by a spring have the spring-barrel located in the lower part of the case.

A clock of this type in my possession has the general appearance of a hall clock of our grandfathers' days except for its diminutive size. It is eight inches high, three-fourths of an inch deep, and one and one-fourth inches wide. The case is beautifully made of dark wood. The upper part of it, enclosing the works, has glass front and sides, the cap over the balance-wheel, as well as the front plate of the works, which are of brass, is open-work of graceful design and is gilded. Another clock of this type, also in my possession, is still more diminutive in size, being only three and three-fourths inches high, one-fourth inch deep, and three-fourths inch wide. It is made entirely of brass except the numerals, which are of silver, and is beautifully engraved and gilded. At the bottom of the case there is a small compartment closed by a hinged door. This contains the key. The numerals are fitted into a dovetail groove in the front of the case, and the hand is carried on a sliding-piece attached in the manner before mentioned to the fuse chain. There are no divisions to indicate the fractions of the hour.

Another interesting example of this type has a dial engraved with a series of logarithmic curves. On the faces of these clocks there are two rows of characters; when the dials are rectilinear, the characters are arranged in two vertical columns; when circular, in two concentric circles. These rows are some little distance apart, and the characters are unequally spaced. Each numeral is connected to its opposite one by a logarithmic curve. The space between the columns is divided into twelve equal parts by parallel vertical lines, each line having at its upper extremity the sign of a month. The space included between the intersections of one of these lines with two successive logarithmic curves, will indicate the length of the corresponding hour for the first day of the month which is indicated by that line. In this clock the index is borne on a cross-bar, which extends across the dial from one column to the other and is attached to the weight-cord. The index is so affixed to this bar that it can be moved along its length, thus passing from one line to the other as the months elapse. When this kind of clock is provided with a circular dial, the logarithmic curves are laid out in the same manner and intersected by parallel concentric circles. The hand moves over the dial and is constructed so as to slide through its attachment to its arbor, thus being lengthened and shortened.

Another clock of this type has a much more complicated structure. Its circular dial revolves and is furnished with movable hour-signs, which are arranged in concentric circular grooves on its face. A pin projecting from the posterior face of each opposite hour-sign enters the groove in a slotted arm which extends across the back of the dial. These arms are acted upon by an eccentric, which in its turn is driven by a train of wheels completing its cycle in a year. The action of this mechanism is such that the opposite ends of the arms and consequently the hour-signs are separated and approximated as the days and nights vary in length.

It only remains to describe the clocks of the second class, viz., those in which the rate is made to vary in accordance with the seasons. None of these clocks, as far as I am aware, have the balance-wheel and hairspring, but they have its forerunner and immediate ancestor, the escapement of Huygens, which consists of a vertical staff suspended by a fine silk thread attached to its upper end. This staff is provided with lugs which engage the teeth of a crown-escapement wheel, and it bears a horizontal arm from which small weights are suspended like a scale-beam. The rate of the clock is regulated by the adjustment of these weights. In general form, these clocks are rectangular or cube-shaped. The gong is placed on top of the case. The dial is circular and revolves from right to left, the hand being stationary. The case is of brass and is usually highly ornamented. The variation of rate in these clocks is accomplished in two ways, viz., (1) entirely by the adjustment of the weights borne on the arm of the

escapement, and (2) partly in the foregoing manner and partly by the mechanism itself; the latter form having a double escapement, which will be described later.

The specimen of the former kind which I have is two and one-half inches wide, two and one-half inches deep, and seven inches high over all. The case is of brass, and is beautifully ornamented by chasing, and the wheels, which are cut by hand, are very accurately made. The characters are engraved on the dial in two circles, the outer one being composed of the signs of the Chinese Zodiac, and the inner one, of the hour-signs. Below the dial, on the face of the clock, are two openings, through each of which may be seen an astrological character. These characters change once in twenty-four hours. The weight-cords run over spiked pulleys and have small counter-weights. The clock has a striking-train and a going-train.

Another clock of this form in my possession is of more complicated construction. It has two escapements, the horizontal arms of which are of different lengths. In this clock the variation of rate is accomplished partly by hand and partly by the automatic operation of the mechanism itself. One escapement remains idle during the day and the other during the night, the staff of one being lifted from its engagement with the escapement-wheel at the same time that the other is brought into gear. This is accomplished by two levers which lie directly below the ends of the vertical staves of the balance. The opposite ends of these levers are acted upon by two cams on the same arbor which cause one of them to rise and the other to fall at the proper moment.

I have omitted to say anything of the fantastic astrological meanings of the various characters found on these clocks and of the intimate connection between the astronomy, astrology, and horology of the Japanese, and will only add that if they are children in imagination they are certainly giants in mechanical execution.

In writing this article I have availed myself of the articles written by Emil James, *Journal Science D'Horology*, Vol. VIII.; Anet and Thomas Eggleston, Ph.D., in the *School of Mines Quarterly* for July, 1892.

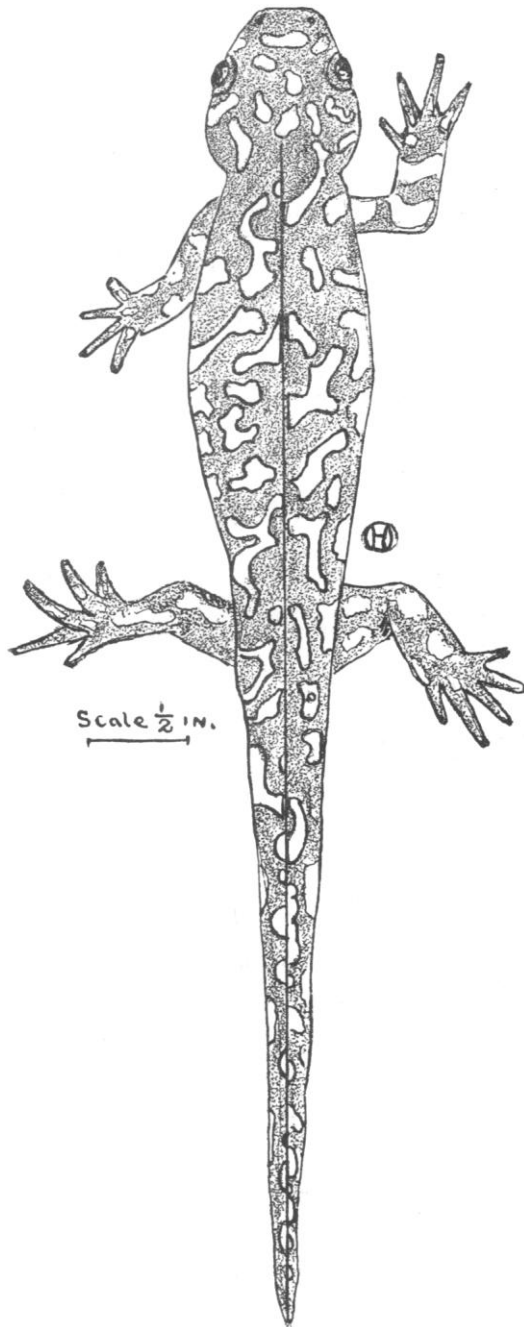
SOME BIOLOGICAL NOTES ON AMBLYSTOMA TIGRINUM I.

BY HENRY LESLIE OSBORN, PH.D., ST. PAUL, MINN.

THERE is a salamander, most probably of the species named above, which is very common in this vicinity. In the autumn months, especially during September, it can be found abundantly in cellars or in damp, dark, or semi-dark places about buildings. I have often seen it on the railroad tracks imprisoned between the rails, and many specimens which had been run over and killed by the cars can be found at this season. Occasionally they are seen creeping about on the walks or in the grass, where they are frightened by man's approach and run actively away. They are familiarly called lizards, and the use of that word among the people of this vicinity can almost always be understood to refer to this animal. It lives in aquaria for an indefinite time, remaining on the bottom, and coming to the surface for renewal of air of the lungs rarely.

1. The *markings* of this salamander are vivid yellow spots upon a ground of brown-black upon the back, giving place to faint bluish ground and lighter color on the ventral surface. There is a very great deal of variation in the shape and distribution of the spots. In general, they are irregular, elongate figures of various sizes from very small rounded ones up to those of considerable size, whose length may be equal to half an inch. The directions of the long ones of the spots are not the same, while they are chiefly antero-posterior, some are oblique from behind, forward and inward, while others are oblique from behind, forward and outward. The patterns of the two sides are not "mated," they are entirely independent. Not only so, but there is a distinct line which separates them, and in the middle a black line often cuts directly through the spots, so that, while they meet, they do not match. This last-named condition is very noticeable in the tail, as shown in the accompanying figure. It is very conspicuous in many cases, but perhaps less noticeable in specimens

not so largely spotted as the one used in making the figure. This absence of bilateral symmetry in the skin markings is a more or less general phenomenon in the coloration of animals; they rarely having their two sides perfect counterparts. It is in fact a case of a general law, applying to all bilateral organs, perfect bilaterality being a very rare phenomenon, due, on modern biological views, to the preponderance of growth in the cells of one organ over its homologue of the opposite side through the operation of any of the several causes which influence vitality



of cells, e.g., use, nutrition, disease, perhaps inheritance. But, in animal coloration, while perfect bilaterality of marking is unusual, and a certain independence of the opposite sides is usual, it is rarely carried so far as here. The markings of birds, etc., blend across the middle line, so, too, the blotches of snakes, frogs, and other familiar cases, and I have never seen an animal in which the independence of the color markings of the two sides is as pronounced as it is in this form. A fact of this kind would appear to have some important suggestions in relation to the ontogenetic history of the yellow color producing cells. If they are separated early in their history and continue distinct, we

should expect such a separation in their ultimate products. There are facts enough to indicate that in lower forms, such as annelids, the cells of the two sides of the body in many of the organ systems are separate from an early date, even as early as in the early segmentative stage of the egg (cf., E. B. Wilson, "The Cell Lineage of Nirus," *Journal of Morphology*, vol. vi., p. 36, 1892). This supposition would not be out of accord with the fact that the independence of coloration is found in a lower rather than one of the higher animal groups and in a lower member of its group, for it is the characteristic of the higher forms to have more and more intimate relation of parts. The distribution of the color-spots I cannot as yet reduce to any law by study of adults, and I know of no observations in the embryology of *Amblystoma* which have been directed upon this point. There seem to be some faint suggestions of metamerism in the coloration of the area of the side walls of the body, especially between the limbs. The body wall in this region is marked on the ventral aspect and laterally by rings (Myotoms), which correspond with the attachments of the muscle fibres, and the color spots are rather noticeably located upon the rings rather than on the spaces between them. The rings look like somites of an annelid, and it would be interesting to know if they correspond with the segmentation of the vertebrae and nervous system.

2. The movements and locomotion of the salamander are very interesting to observe. They suggest an animal which is passing from the use of the back-bone and its curvatures as a mechanism for locomotion to the use of limbs. The locomotive movements are of two classes, the first are those performed under ordinary circumstances, the second those performed to escape from a pursuer, as when one attempts to seize the creature. The former are made by means of a combined use of the back-bone, which is thrown into gentle curvatures, and the legs, which are the chief instruments in the act. The curvature of the back-bone is such as to throw the limb to be used forward further than it would be with the spine kept straight. The limbs are used in strict alternation, the right front leg and the left hind leg going forward together, and then backward together, while the spine has a convexity toward the right in the brachial region and toward the left in the sacral region. The creature, in water, when disturbed by one's hand generally either makes a disorderly scramble with the limbs, which has but little result, or it swims swiftly with a truly fish-like situation of the body, including the large post-anal region or "tail," which is much compressed and forms a very efficient organ of swimming. It has seemed to me that this swimming motion may be a case of physiological reversion. We know that the vertebral musculature is far more ancient phylogenetically than the limb musculature, and we may suppose that hence the power to control it nervously is far greater than that to control the more recently acquired limb musculature. It is a case of the tendency to fall back on the ancestral mode of action so long as the structure will permit, especially under circumstances in which the animal is under the influence of strong excitement, which would tend to weaken the more recently acquired powers and allow the ancient lines of habit to become dominant. This tendency can be discerned in many other cases; thus, for instance, I regard the case of the crayfish as precisely similar to the one just cited. It commonly moves by a walking motion, not using the flexion of the abdomen, but under excitement of escape it reverts to this ancestral action, and the familiar "crawfish" movement results. I do not think it is at all beyond the range of reason to include the tendency of people to lapse into a native language from an acquired one in moments of excitement under the same principle of physiological reversion. In this connection, I may speak of a specimen of *Necturus*, which I had for some time in an aquarium in the laboratory, in which the swimming movements were even more noticeable than in the salamander, a fact co-ordinated with its more piscine peculiarities in other respects.

It is possible to discover in the movements a suggestion of the origin of limbs. The limbs are usually in a line, and the front right leg is thrown forward by the curvature of the body at the same time that the left hind leg is thrown forward by the curvature in its level. Limbs at these points, if at first mere stumps,

would be of advantage by the hold they would give to the squirming body. Then elongation would increase the advantage. No loss of this function would be necessary, but a gain, if the limb acquired some independent motion, and this might be developed enough to render it capable of officiating as the sole locomotive organ. If such a history of the limb were true, the salamander is midway in the line of descent.

3. The *post-anal region* of the salamander is piscine, while the anterior portions of the body are not, but are distinctly higher. This fact is more or less familiar in a general way and called by Professor Hyatt, who pointed it out many years ago, by the name "cephalization." This advance of the anterior part of the body of the salamander has left the "tail" to be in many respects not amphibian so much as piscine. Of course the term tail here means post-anal region of the body and the portion, roughly speaking, homologous with the post-anal region of the fish. In the higher fishes this region has acquired a "tail," while the amphibia have not shared the acquisition of a structure supported by five rays, which does not belong to the ancient vertebrate stock. In this sense the tail of the salamander and its correlate, the post-anal region of the fish, are not only similar in function, being organs of locomotion, but they are comparable in their anatomy. The back-bone is acentrum with bi-concave surfaces with two equally developed arches, a neural arch containing the spinal cord, and an haemal arch containing a vein and an artery with oblique intervertebral muscles forming the back of the organ. In vertebrates above the urodela, with the loss of its locomotor function and the development of arms and legs, the post-anal region becomes of less and less importance, though not always disappearing; thus in many lizards it is large at its origin, as large as the body before it, and it has the peculiar power of *autotomy*, as it has been called; that is, of breaking off in the hands of a captor, whereby the animal escapes capture. There is a gradual degeneration of the region among the higher vertebrates, with many varieties of direction and degree of development and occasional utilities in peculiar directions, and the salamander stands at the bottom of this series.

4. The *death of the salamander* is accompanied by a loss of powers of movement, which is first manifest in the last acquired (phylogenetically) of the powers, i.e., in the limbs, and finally in the vertebræ muscles. In specimens killed under the influence of chloroform, after all movement had ceased in the limbs, the sinuations of the back-bone continued for some time, and were the last movements observed to take place.

REFLEX ACTION IN TURTLES.

BY M. J. ELROD, ILLINOIS WESLEYAN UNIVERSITY, BLOOMINGTON, ILL.

RECENTLY I had a number of map turtles (*Malaclemys geographica* Le Sueur) for student work, and observed, what is to me, a remarkable instance of reflex muscular action, both in the head and limbs. In one specimen the head had been severed from the body fully an hour, when I observed the students amusing themselves by tapping the nose of the severed head, when almost as quickly as in life the jaws would open, and when a pencil or other hard object was thrust in would close upon it with seemingly as much viciousness as in life, continuing to hold for some time, gradually relaxing, when the experiment would be tried over again. This was the case not only with the one in question, but with a half-dozen others of the same lot. Taking a specimen with the head cut off and all the viscera cleared away, leaving the legs attached to the carapace, the legs manifested sensitiveness to a marked degree. In one specimen the four legs extended from the body almost straight; a very gentle touch with the point of a pencil on the tip of a claw caused that leg to be drawn within the shell, so to speak, as quickly as in life. This was done alternately with each foot to the first again, all giving the same results. Several other specimens tested showed as much and as sudden movement, and one killed at 2 P.M., when touched at 11 A.M. the day following, withdrew its feet instantly. While these observations are common for turtles, I have not observed such marked results in other species.

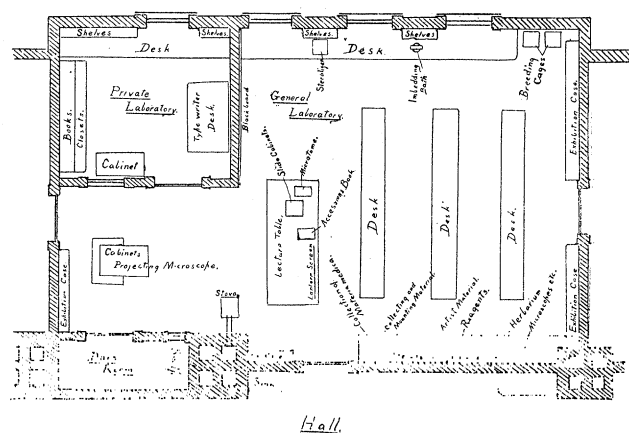
A LABORATORY OF PLANT DISEASES.

BY C. W. WOODWORTH, BERKELEY, CAL.

THERE has recently been equipped at the University of California a laboratory for the study of the subject of plant diseases in its broadest sense; and, as there are but few if any others where the whole subject is taught as a unit, it may be well to give an outline of the equipment for this class of work.

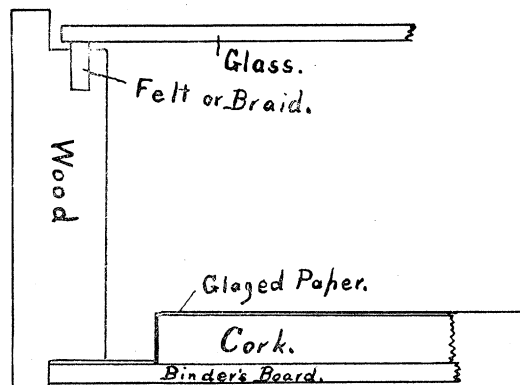
We will not consider that part of the equipment for this work afforded by the grounds, orchard, nursery, gardens, and green-houses of the agricultural department, but confine ourselves to the laboratory proper. The subject of plant diseases is now, and will continue to be, associated with that of entomology, so that the same equipment, to a considerable extent, serves for the two subjects.

The laboratory-room is something over twenty by thirty feet, and is situated on the north side of the Experiment Station building. It is lighted by four windows, having an entirely unobstructed view, and so giving ample light for microscope work. A corner of the room is partitioned off for a private laboratory, and a closet is fitted with a ruby window, affording an opportunity for photo and blue-print work. The figure below will give a good idea of the arrangement of the room.



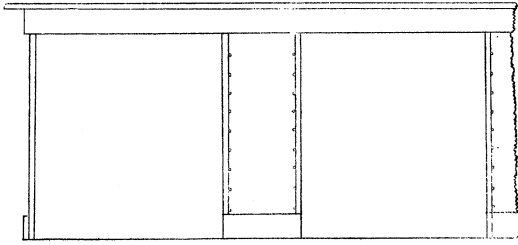
The windows are all fitted with heavy shades working in grooves, enabling one to darken the room very easily and quickly when the lantern is to be used for illustration. The views are projected on a screen of tracing-cloth, which is mounted on an ordinary spring-roller and is ordinarily rolled up out of the way.

Besides the benches near the windows, which are used by advanced students, there are also three long desks, one and a half feet wide by twelve in length, that have proven themselves so convenient that a sketch of one is presented. As can be seen on the plan, these are so constructed that at the side of each student boxes, the size of those of the collection, may be used as drawers, or boards may be inserted forming shelves.



The boxes used for the collection are made as shown in the accompanying figure, and are from their peculiar construction not liable to warp or crack, and so remain perfectly insect-proof.

The cloth bearing for the glass is treated with corrosive sublimate, and the paste and glue used are arseniated. These boxes are kept in cabinets, the glass doors of which are fitted with a rabbited groove on all four sides, thus making them also dust- and insect-proof.



The collections kept in these cabinets are arranged in three series. Series one is the systematic collection, where the organisms producing injuries to plants are grouped in the ordinary order, beginning with mammals and ending with the higher plants. The second series is the "host" collection, where the various plants are taken up in an agricultural order, as, for instance, seed crops, fruit crops, etc., and the injuries to each particular crop illustrated. In the third series, the symptomatic collection, all diseases having a common symptom are brought together, thus all galls and distortions from whatever cause or on whatever plant are assembled and classified.

Besides these there are the beginnings of a cryptogamic herb-arium in drawers and a collection representing the materia medica of plant diseases.

There are in the laboratory a sterilizer and all the other necessary apparatus for this class of bacteriological work. For microscopical and histological work there is also a good equipment including paraffin bath, microtome suitable for the highest grade of work, compound microscopes and accessories, and a very good outfit of reagents.

All reagents, as far as possible, are kept in standard strengths, and the bottles marked to serve as graduates for dilution. Thus the chromic acid is made up in a large bottle into a 5 per cent solution. The 1 per cent solution is made by filling the bottle to contain it to a mark and adding water. Most of the chromic mixtures are made from the one per cent. The chromic-acetic killing mixture, for instance, is made, as is indicated on the label, from one-half per cent chromic acid to the first mark, 95 per cent alcohol to the second, and 10 per cent acetic acid to the neck. Mixtures liable to deteriorate are kept in small bottles, and such as the acid-alcohols for decolorizing are not kept mixed at all, but large homo vials are properly labelled and the mixtures made up as used.

This sketch gives merely the present condition of the laboratory, it is expected that apparatus will be added from time to time as opportunity offers and as it is needed for the work in hand; indeed, there is considerable new apparatus at the present time being constructed for the laboratory.

AN IMPORTANT COLLECTION OF MOLLUSCA.

BY HENRY A. PILSBRY, ACAD. NAT. SCI., PHILADELPHIA.

It is not generally known, even among specialists, that one of the most valuable and most instructively arranged collections of Mollusca in America, is that which Professor Henry A. Ward has brought together at Rochester, N.Y. This collection the writer has recently had an opportunity to examine, and it is believed that some account of it may be useful not only to specialists in Mollusk morphology, or conchologists desiring to see rare shells, but also to those who look upon a collection especially as an instrument of education for class or public use.

The primary idea of Professor Ward's collection is to give the spectator not only a comprehensive but a *comprehensible* view of all phases of Mollusk life; and to this end a number of the more typically developed forms of each genus have been selected for exhibition. The practical advantage in limiting the number of species representing each genus will be readily admitted by those who have observed the effect, on the non-scientific observer, of

the vast wilderness of similar species exhibited in some of the public museums of our large cities.

A further purpose has been to procure the best specimens obtainable of each species represented, and to select not merely the rare and beautiful, but, before all, species and specimens which have a life history worth knowing, and can tell it themselves.

The dry specimens of shells are contained in horizontal glazed cases disposed around the sides of two rooms,—in all, about 220 linear feet of cases. Wall-cases behind them contain alcoholic Mollusks, and drawers below hold additional species. The specimens are mounted upon light wooden tablets, appropriately colored, and made by gluing two pieces together, crossing the grain to prevent warping. Labels for families and higher groups are printed, and in most cases contain a concise statement of the fundamental characters of the group. The shellless forms, such as most Cephalopods and the *Nudibranchiata* are represented by Blatschka's beautiful models, now, alas! no longer obtainable.

A few hasty notes upon some of the specimens may be of interest. Upon entering the outer room one sees suspended from the ceiling a life-size model of the gigantic Squid (*Architeuthis*) of the North Atlantic, its suckered tentacular arms thirty feet in length. The actual existence of such monsters almost makes us forgive old Denys de Montfort for his picture of a "Poulpe Colossal" dragging down a full-rigged ship! The first horizontal cases contain shells of the Paper Nautilus; then several species of the Chambered Nautilus. A specimen of the animal of the latter (*Nautilus pompilius*) in its shell is one of a very few in America; though the shells are not uncommon, this remnant of a Palæozoic and Mesozoic race is rarely found in the flesh. The pelagic Pteropods are arranged after the Cephalopods, and then the air-breathing Gastropods. The latter series begins with carnivorous forms, the worm-eating genus *Testacella*, in which the shell is degenerate, owing to its subterranean habits, standing first,¹ followed by the Floridian *Glandina*, which has a well-developed shell, and subsists largely upon snails, swallowing them whole and digesting the soft parts out of the shells at leisure. Following these are the Achatinas of Africa, largest of land snails. The striped, oval shells are 8 or 9 inches long. With them are specimens of their eggs, hitherto, I believe, undescribed. They are about the size of a sparrow's egg, oval, with calcareous shell, and of a bright sulphur-yellow color; the only case known to me of a land snail having colored eggs.

In an adjacent case are the South American Bulimi, *Tomigerus* and *Anostoma*, having upturned apertures. An Amazonian Indian who collected them said to Professor Ward, "God laughed when he made these shells."

The numerous families of marine gastropods are represented by characteristic specimens, among them a good number of species which, to my knowledge, are not in any other American museum. The families *Volutidae*, *Conidae*, and *Muricidae* may be mentioned as affording valuable material. An example of *Xenophora conchyliophora* carried a load of rounded pebbles soldered to his shell instead of the usual disguise of shells and shell-fragments, obviously showing the character of the sea-bottom he lived upon, and an ability to adapt himself to unusual circumstances.

In the *Turbinidae* we examined the unique type of *Astraliun Wardii* Baker, and incline to consider it a form of *A. Japonicum* Dkr. It will be of interest to conchologists to learn that the hitherto unknown operculum of *A. modestum* Rve. of Japan is represented by several specimens, and that it proves to be of the same abnormal type as that of the Mediterranean species, *A. rugosum*, the form and the position of the nucleus being the same in both. The operculum of *A. modestum*, however, is pure white, while that of the other species is scarlet.

The series of Lamellibranchiata is of equally great extent. But further enumeration would be tedious. We may confidently state that those interested in science-education or in animal life-history and structure will find, as the writer has done, that this collection is full of most valuable suggestions and material, and will well repay a visit to Rochester.

¹ The writer has recently shown that the South African genus *Aerope* is more highly specialized than any other carnivorous land-snail, and it should therefore be given first place in the series.

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NON-EUCLIDEAN GEOMETRY.

BY G. A. MILLER, PH.D., EUREKA COLLEGE, EUREKA, ILL.

EUCLID's elementary geometry was written about three centuries before the Christian era. We must conclude that it was much superior to all preceding works on this subject. Proclus, who wrote a commentary on Euclid's *Elements* in the fifth century of our era, represents it such, and his statements are corroborated by the facts that all similar works of Euclid's predecessors have ceased to exist, and, if any elementary geometry was written by a Greek after Euclid, there is no mention made of this anywhere.¹

The facts that Euclid's *Elements* are still used as a text-book—especially in England—and that the works used in its place are generally based upon it, are perhaps still stronger evidences of its excellence.

No geometry can be written without making some assumptions with respect to the space with which it deals. These are generally of such a nature as to commend themselves to our full confidence by their mere mention, and are commonly called axioms. It is the duty of the geometer to demonstrate properties and relations of magnitudes by non-contradictory statements which rest ultimately upon these axioms. It is evident that the axioms should be as few and as clear as possible. Upon essentially different axioms essentially different geometries may be established.

Among the axioms of Euclid there is at least one which is not axiomatic.² This is the axiom of parallels, which reads as follows:—

"If a straight line meet two straight lines so as to make the two interior angles on the same side of it taken together less than two right-angles, these straight lines, being continually produced, shall at length meet on that side on which are the angles which are less than two right-angles."

All the popular text-books on elementary geometry employ this axiom either in this form or in some shorter form, such as, "Through a point without a line only one line can be drawn parallel to the given line."

Many efforts have been made to demonstrate this axiom. Since it does not depend upon more elementary axioms, such attempts must be futile. If we assume it to be true, it follows directly that the sum of the three angles of a plane triangle is two right-angles; and, conversely, if we should assume that the sum of the internal angles of a plane triangle is two right-angles, this axiom would follow.³

As the geometers who do not adopt all the axioms of Euclid deny this, non-Euclidean geometry is sometimes defined as the geometry which does not assume that the sum of the three angles of a plane triangle is two right-angles. A more satisfactory defi-

nition is, non-Euclidean geometry is a geometry which assumes other properties of space in place of the following properties of Euclidean space:—

The sum of the three angles of a plane triangle is two right-angles, space is an infinite continuity of three dimensions, and rigid bodies may be moved in every way in space without change of form.

Just one hundred years ago (1792) the famous mathematician Gauss began the study of a geometry free from the first of these assumptions. He did not publish the results of his study. We may infer something in regard to them from his letters.⁴ It was not until 1840 that a geometry was published in which Euclid's axiom of parallels was replaced by another, and the sum of the angles of a plane finite triangle was thus shown to be less than two right-angles. The work was written by a Russian mathematician named Lobatschewsky. It contains only sixty-one pages and bears the title "*Geometrische Untersuchungen zur Theorie der Parallellinien*." He began his treatment of parallels by observations, in substance, as follows:—

Given a fixed line (L) and a fixed point (A) not on this line. The lines through A lying in the plane determined by A and L may be divided with respect to L into two classes—(1) those intersecting L , and (2) those not intersecting L . The assumption that the second class consists of the single line which is at right-angles with the perpendicular from A to L is the foundation of a great part of the ordinary geometry and plane trigonometry. While the assumption that the second class consists of more than one line leads to a newer geometry, whose results are also free from contradictions.⁵ This newer geometry was called non-Euclidean geometry by Gauss, imaginary geometry by Lobatschewsky, and absolute geometry by Johann Bolyai.⁶

It is certainly of interest to learn what some of the foremost mathematicians have said with respect to this geometry. Professor Sylvester said in regard to Lobatschewsky's work:—

"In quaternions the example has been given of algebra released from the yoke of the commutative principle of multiplication—an emancipation somewhat akin to Lobatschewsky's of geometry from Euclid's noted empirical axiom."

Professor Cayley said:—

"It is well known that Euclid's twelfth axiom, even in Playfair's form of it, has been considered as needing demonstration; and that Lobatschewsky constructed a perfectly consistent theory wherein this axiom was not assumed to hold good, or, say, a system of non-Euclidean plane geometry."

Another very eminent mathematician, Professor Clifford, in speaking about the same work, said:—

"What Vesalius was to Galen, what Copernicus was to Ptolemy, that was Lobatschewsky to Euclid."

Something of the nature of this geometry may be inferred from a few of its theorems which differ from the corresponding theorems of the ordinary geometry. In addition to the important theorem that the sum of the internal angles of a plane finite triangle is less than two right-angles, it is proved that if we have given a line (L) and a perpendicular (B) to L , the parallels to L through points on B will make angles with B varying from $\frac{\pi}{2}$ to 0; so that we can draw through B a parallel to L making any given angle with B .⁷

The locus of a point at a constant distance from a straight line is a curved line.⁸

The areas of two plane triangles are to each other in the ratio of the excesses of two right-angles over the sums of their angles.⁹

We proceed now to some observations on the second property of Euclidean space mentioned above, viz., that space is an infinite continuity of three dimensions. We shall not take up the question of the infinitude of space nor Riemann's distinction between

⁴ Briefwechsel zwischen Gauss und Schumacher,—especially Vol. II., pp. 268-271.

⁵ Lobatschewsky's *Theorie der Parallellinien*, Art. 22.

⁶ Frischauf's *Absolute Geometrie*, Art. 13.

⁷ Lobatschewsky's *Theorie der Parallellinien*, Art. 23.

⁸ Frischauf's *Absolute Geometrie*, p. 18.

⁹ Frischauf's *Absolute Geometrie*, p. 50.

¹ Cantor's *Vorlesungen über Geschichte der Mathematik*, Vol. I., p. 224.

² *Encyclopædia Britannica*, Vol. VIII., p. 657.

³ Frischauf's *Absolute Geometrie*, pp. 14, 15.

infinite and undounded as applied to space, we shall content ourselves with a few remarks on the number of dimensions of space.

In ordinary geometry we say that the limit or boundary of a solid is a surface, the limit of a surface is a line, the limit of a line is a point, while the point is indivisible. The same thought is expressed in other words when we say a solid has three dimensions, a surface two, a line one, while a point has no dimensions. Although the question of three dimensions of space has engaged the attention of many philosophers, no one has succeeded, to the present, to give a deep reason which is not based upon our experiences why after three passages over the limits (beginning with a solid) we should arrive at the indivisible.¹ Our inability to conceive solids or figures of more than three dimensions does not disprove their existence. If we imagine a world of two dimensions, in which all things consist of two dimensional figures, in which the inhabitants are so constituted that they can receive impressions only from things in the surface which constitutes their universe, and if we consider how unthinkable to such beings might appear figures of three dimensions, we may perhaps be prepared to admit the possibility of a space of more than three dimensions.²

The relations of algebra and geometry are such that an equation involving n unknowns ($n \geq 3$) finds its geometric interpretation in a space whose dimensions are equal to the number of unknowns in the equation. The dual (algebraic and geometric) solution of algebraic equations enhances greatly their value and interest. Algebra does not restrict itself to a fixed number of unknowns. The question whether there is a corresponding practical geometry of a space whose dimensions are not fixed is of the greatest interest. We shall designate such a space by E_n , ($0 \leq n \leq \infty$), hence E_n contains all the points of this space.

In constructing a geometry for E_n it is necessary to select a set of axioms. These axioms must be so chosen that when E_n becomes an E_a ($0 \leq a \leq 3$) this geometry will lead to results harmonizing with our experiences. We proceed to give a few of the assumptions from an approved work on n -dimensional space.³

Through each point pass many E_{n-1} having the following properties:—

Through point of an E_{n-1} pass many E_{n-2} on which the E_n may be moved; by this motion the E_{n-1} may be made to occupy completely its first position, while the individual points have changed their positions.

In each E_{n-2} there are many E_{n-3} on which the E_{n-1} may be rotated in itself. By this rotation each point will describe a closed curve.

Starting with such assumptions, a geometry is constructed by collecting and classifying theorems which rest ultimately upon them. It is perhaps worthy of remark that attempts have been made to prove the impossibility of a fourth dimension.⁴

As the main object of this article is the presentation of the non-Euclidean geometry of two dimensions, we proceed to develop the foundations on which rests a still more general two-dimensional geometry than the one noted in the fore-part of this paper. The understanding of the following processes will demand some mathematical attainments beyond what is required to appreciate the preceding. The formula which we desire to use is given in Killing's *Nicht-Euklidische Raumformen*, p. 14. We shall here give a simple outline of its development, referring the reader to that work for the rigorous proofs of some of our statements. We give here two almost axiomatic theorems which we shall need later.

To a triangle whose sides are all infinitesimals all the princi-

ples of the ordinary geometry and plane trigonometry apply, independent of the axiom of parallels. If one angle of a triangle becomes an infinitesimal while the others remain finite, the ratio of the sides including the infinitesimal angle has unity for its limit.

Given a triangle with a constant finite side (c) and a constant adjacent angle β , while the other adjacent angle (a) is infinitesimal. The side (a) opposite a must also be infinitesimal. The lines which divide this a into n equal parts also divide a into n equal parts. Hence the ratio $\frac{a}{a}$ depends not upon a (a remaining infinitesimal) but upon c and β . The limit of this ratio when $\beta = \frac{\pi}{2}$ and a is in the act of vanishing is denoted by $f'(c)$. For

any other value of β this limit is $\frac{f(c)}{\sin \beta}$. Let c increase by an infinitesimal h , and $\frac{a'}{a} = \frac{f(c+h)}{\sin \beta}$. Since $\frac{\sin \beta}{a} \times \frac{a' - a}{h}$ has a finite limit when h is in the act of vanishing, its equal, $f'(c)$, must have the same limit. We may suppose a triangle formed by keeping β and c constant while a increases to a finite angle. We thus obtain a triangle in which a, β, c are finite. We will call the third side and the third angle b and γ , respectively. In this triangle we may let a undergo an infinitesimal increase, da , at the same time a, b, γ will increase by $da, db, d\gamma$, respectively. This increase of the triangle is a triangle like the one just considered, and the formulas obtained are directly applicable to it. The following formulas can easily be proved:—

$$(1) \quad \frac{da}{da} = \frac{f(b)}{\sin \gamma}, \quad \frac{d\gamma}{da} = -f'(b), \quad \frac{db}{da} = \cos \gamma.$$

The first has been found in the preceding triangle. From it we also obtain—

$$\frac{\sin(\pi - \gamma)}{da} \times \frac{a' - a}{h} = f'(b);$$

$$\text{but} \quad \frac{a' - a}{h} = \frac{\sin[\pi - (\pi - \gamma + \gamma + d\gamma)]}{\sin \gamma},$$

hence the second equation. The third follows directly after drawing perpendicular from γ upon the side $b + db$.

From equations (1) we obtain easily—

$$\frac{f(b) db}{f(b)} = -\frac{\cos \gamma d\gamma}{\sin \gamma}.$$

Integrating this—

$$\log f(b) = -\log \sin \gamma + \log C.$$

When $a = 0$, it follows that $b = c, \gamma = \pi - \beta$. From this we find $\log C$, and the equation takes the form

$$f(b) \sin \gamma = f(c) \sin \beta.$$

Differentiating, a and c being regarded constant, we obtain

$$f'(b) \sin \gamma db + f(b) \cos \gamma d\gamma = f(c) \cos \beta d\beta.$$

Substituting from (1), remembering that β, b takes the places of a, a , there results

$$f(a)f'(b) - f(b)f'(a) \cos \gamma = f(c) \cos \beta.$$

Hence, cyclically,

$$f(a)f'(c) - f(c)f'(a) \cos \beta = f(b) \cos \gamma.$$

Multiplying the last by $f'(a)$ and subtracting from the preceding there results,

$$f(a)[f'(b) - f'(a)f'(c)] = f(c)[1 - \{f'(a)\}^2] \cos \beta.$$

Combining with this the analogous equation

$$f(c)[f'(b) - f'(a)f'(c)] = f(a)[1 - \{f'(c)\}^2] \cos \beta.$$

By division,

$$\frac{\{f'(a)\}^2}{1 - \{f'(a)\}^2} = \frac{\{f'(c)\}^2}{1 - \{f'(c)\}^2}.$$

Since a and c are independent, the members of this equation must be constant. Hence the important equation—

$$\frac{\{f'(c)\}^2}{1 - \{f'(c)\}^2} = k^2$$

¹ Killing's *Nicht-Euklidischen Raumformen*, p. 64.

² A short romance, entitled "Flatland," depicts the difficulty an inhabitant of a two-dimension world (a square) had to conceive of three-dimensional space, even after he had acquired some idea of a one-dimension, or line, world. The book is published by Roberts Brothers, Boston, Mass.

³ Killing's *Nicht-Euklidischen Raumformen*, p. 65.

⁴ Max Simon, *Zu den Grundlagen der nicht-euklidischen Geometrie*, p. 26.

In which k is some constant. Substituting from (1) we obtain

$$\frac{1}{k^2} = \frac{da^2 - dy^2}{da^2 \sin \gamma}.$$

By making $\frac{1}{k^2} = 0$, we obtain $da = dy$, which, from the triangle in which these occur, is equivalent to saying, the sum of the angles of a plane triangle is constant and equal to two right-angles. This hypothesis leads to the Euclidean, or parabolic, geometry, making $\frac{1}{k^2} < 0$ makes $dy > da$, which shows that the sum of the angles of a plane triangle is less than two right-angles, and leads to Lobatschewsky, or hyperbolic, geometry. Finally, the hypothesis $\frac{1}{k^2} > 0$ makes $da > dy$ and indicates that the sum of the angles of a plane triangle is greater than two right-angles. This gives rise to the elliptic geometry. The last is divided into two divisions—the single elliptic geometry and the double elliptic geometry. The names parabolic, hyperbolic, single elliptic, and double elliptic were applied to these spaces by Klein. The last two kinds of space are nearly alike. Euclidean geometry may be regarded as the common limit of the hyperbolic and the elliptic geometry. Considerations similar to the preceding lead to four kinds of n -dimensional space, and hence there are four kinds of n -dimensional geometry.

ALTAKAPAS COUNTRY.

BY JOHN GIFFORD, SWATHMORE COLLEGE, PA.

IN the southern part of Louisiana there is an interesting region called the "Altakapas Country." It was once inhabited by a tribe of Indians of that name. They have the reputation of having been cannibals, but the later generations were peaceful and industrious. A few of them, they say, still exist and are famous for the skilful manner in which they make a peculiar kind of basket-work. Specimens of this may be seen in the museum of the Tulane University of Louisiana.

Roughly speaking, the region referred to embraces the land bordering the Gulf, west of the Atchafalaya and east of the Mermentau River. There is some discussion as to the extent of the country known by that name. As ordinarily used the term is elastic, but in a map printed in 1826 it includes all of what was then known as La Fayette, St. Mary's, and St. Martin's parishes and what is now known as Vermillion, La Fayette, St. Martin's, and St. Mary's.

Excepting five islands to which I shall refer later, this country is low, level, and rich. It is a part of the alluvium of the delta, which is intersected by many bayous, the arteries of Louisiana. The Atchafalaya is sometimes called "Old River," and was once no doubt the bed of the Mississippi. To-day it is reddened by the water from the Red River, in the mouth of which it begins. It is now perhaps the largest collateral artery of the main trunk. It was once clogged by an enormous raft, which was removed by the State in 1835. According to LeConte, it "was a mass of timber eight miles long, seven hundred feet wide, and eight feet thick. It had been accumulating for more than fifty years, and at the time of its removal was covered with vegetation, and even with trees sixty feet high."

The Altakapas country consists of tilled lands, low meadows, and sea-marshes. The thrickest of the first extends along that tortuous, sluggish stream called Bayou Teche. It is very rich and well cultivated, and by many is considered the garden-spot of the State. The banks of the Teche are lined by beautiful sugar plantations with old-time palatial residences and many modern refineries. Cane is there worked, and sugar and molasses manufactured according to the latest scientific methods. Enormous quantities of sugar, molasses, rice, cotton fibre, oil, and meal, and cypress lumber are shipped from this region. Even the moss on the trees is the source of an income of no little consequence.

This bayou begins in a network of streams in the Red River country and empties into the Atchafalaya below Grand Lake.

In few places in the world will you meet with such scenery. A trip down the Teche from St. Martinsville, a quaint town grey with age and "finished" long ago, once called "the little Paris, the land of Evangeline," on a sugar-packet is claimed by many, for scenery of its kind, to be unrivalled outside of Louisiana.

West of the Teche are miles of meadow-land, where many herds of horses and cattle pasture. Southward bordering the bays and Gulf is a region of sea-marshes and floating prairies.

In the midst of this marsh, near Vermillion and Atchafalaya Bays, there is a chain of five islands, the highest land in lower Louisiana. The most western is called sometimes Miller's, sometimes Orange, and sometimes Jefferson's Island. It is the centre of Joseph Jefferson's famous plantation. The second is called Petite Anse or Avery's Island, where the Avery salt mine is located, the like of which, they say, does not exist in this country. The third is Week's Island, the fourth Cote Blanche, and the last Belle Isle.

The fact that five islands exist, much different from the surrounding country, of a different formation, in a straight line, about six miles apart, in the Mississippi Delta is curious. But stranger still the core of Avery's Island is a mass of rock salt of the purest kind, the only impurity, in fact, is .120 per cent of gypsum.

While prospecting for the opening of another mine, they found the bones of the mastodon, giant sloth and perhaps of other extinct animals in layers of material of a peaty nature. Here, also, were found beautiful potsherds and kitchen middens of the Indians who once lived there. There were also indications, I was told, that the Indians knew of the presence of this salt, although, according to Dr. Hilgard, it was not discovered by the whites until 1862. The bones and potsherds which were found there are now in the museum of the Tulane University of Louisiana.

To scientists and sightseers these mines are well worthy a visit, but unfortunately are rather inaccessible. It is easiest reached from New Iberia on the Southern Pacific Railroad. There is a freight train running to the mines, which carries a passenger car. This remains, however, only long enough to collect the freight, which is seldom more than thirty minutes. There is only one train daily. The wagon-road is dangerous at times and never pleasant for vehicles owing to much mud, bad bridges and a pole-road over the marshes. The best way to reach it is on horseback, and for this purpose the Acadian ponies have no equal. They have a peculiar gait, faster than a fast walk, and lift their feet in a quick peculiar manner, which comes, they say, from pulling their feet quickly out of miry places.

The island is visible a long way off, and owing to the contrast with the surrounding country is very striking and prominent. The soil is pure sand and clay, in places mixed to form a loam.

To enter the mine you are apparently instantly dropped down a shaft one hundred and seventy feet deep. You are then in a huge cake of salt resembling ice. The weight above is supported by huge pillars of salt. Enormous quantities have been removed and the supply seems exhaustless. In places it is as clear and transparent as ice, in others granular, in others dark in color, and in others in irregular waves as though contorted by pressure. Here and there are pockets in which beautiful cubical crystals may be found, some of which the writer collected were $1\frac{1}{2} \times 1\frac{1}{2} \times 1$ inches in size.

Although it affords ventilation, they have been troubled by a slight cave, which of course gradually washes larger in size, and a fine sand is thus washed into the mines.

In the Smithsonian Contributions, Vol. XXIII., Dr. Eugene Hilgard has described this formation in a paper entitled "Geology in Lower Louisiana and the Salt Deposit of Petite Anse Island."

One of the other islands borders on the bay, where there is a bluff from which the formation may be studied.

Over in the neighboring parish of Calcasieu, near Lake Charles, there is a bed of sulphur which promises to become an important industry.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Nervous Diseases and Civilization.

IN Dr. Brinton's note on "Nervous Diseases in Low Races and Stages of Culture" in your issue of Dec. 16, he holds that those are in error who claim that "diseases of the nervous system have greatly increased with the development of civilization." My own very positive conviction, based upon a somewhat extended experience in the treatment of neurasthenic cases, is quite the reverse of this. In hospitals, in dispensaries, and among the very poor everywhere, a typical case of neurasthenia is difficult to find, but among the well-to-do and the intellectual, and especially among those in the professions and in the higher walks of business life who are in deadly earnest in the race for place and power, this peculiar impoverishment of nerve force that we term "neurasthenia" appears with alarming frequency.

Dr. Brinton says also that "civilization, so far from increasing this class of maladies, is one of the most efficient agents in reducing them in number and severity, especially when freed from religious excitement and competitive anxieties."

It should, however, be remembered that these "competitive anxieties," this worry of business and professional life, are the very conditions that civilization fosters and intensifies, and therefore civilization itself, with all that the term implies, with its railway, telegraph, telephone, and periodical press, exciting in ten thousand ways cerebral activity and worry, is the primary cause of this increase of nervousness among the higher classes in all countries. American nervousness is becoming almost a distinctive phrase, and it cannot be denied that in this country there are climatic conditions, and business and social environments, to the influence of which the nervous system is peculiarly susceptible, especially if complicated with evil habits, excesses, tobacco, alcohol, worry, and special excitements. In the older countries men plod along in the footsteps of their fathers, generation after generation, with little possibility, and therefore little thought, of entering a higher social grade. Here, on the contrary, no one is content to rest, with the possibility ever before him of stepping higher, and the race of life is all haste and unrest.

It has been aptly said that "the human body is a reservoir of force constantly escaping, constantly being renewed from the one centre of force—the sun." A perfectly healthy man has a large amount of nerve force in reserve, and this reserve is not often exhausted, even approximately, by the necessary toil and wear of mind and muscle. A nervously exhausted man has a small amount of nerve force in reserve, and this reserve is often and speedily exhausted.

The margin on which he can draw is narrow, may be almost wiped out under the calls of emotion and of mental and bodily labor, but, just as with the strong man, the force is renewed from without by food and repose, so, like the strong man, he can keep on thinking and worrying until he dies, which may be long after the death of the strong man. While nervousness makes life painful and irritating, it does not of necessity shorten life, nor does it always destroy its usefulness. "The Indian squaw, sitting in front of her wigwam, keeps almost all of her force in reserve. The slow and easy drudgery of the savage domestic life in the open air, unblest and uncursed by the exhausting sentiment of love, without reading or writing or calculating, without past or future, and only a dull present, never calls for the full quota of available nerve force; the larger part is always lying on its arms. The sensitive white woman—pre-eminently the American woman—with small inherited endowment of force; living indoors; torn and crossed by happy or unhappy love; subsisting on fiction, journals, receptions; waylaid at all hours by the cruellest of all robbers, worry and ambition, that seize the last unit of her force, can never hold a powerful reserve, but must live, and does live, in a physical sense, from hand to mouth, giving out quite as fast as she takes in,—much faster oftentimes,—and needing

longer periods of rest before and after any important campaign, and yet living as long as her Indian sister,—much longer it may be,—bearing age far better, and carrying the affections and the feelings of youth into the decline of life" (Beard's "Sexual Neurasthenia," edited by A. D. Rockwell, M.D., E. B. Treat, New York publisher).

While Americans are undoubtedly a particularly nervous people, it is well to remember that a large number who think themselves nervously exhausted altogether misconceive their real condition. There is a vanity of disease as well as of dress. Many would rather be thought nervous than bilious or gouty, and are pleased with a diagnosis which touches the nerves rather than the stomach, bowels, or liver. As a matter of fact, the nervous system in many of these cases is strong enough, and would give no trouble were it not poisoned by the abnormal products of digestion that enter the blood and circulate freely through every tissue of the body, and the practical and all-important point is, to differentiate between these two classes. The array of symptoms in each class of cases is so much alike that real impoverishment of nerve force due to overwork and worry is often confounded with a poisoned condition of the system, the result of indolent habits and an excess of food; and, instead of rest, quiet, and soothing draughts, there is need of mental and physical activity,—less not more food, depletion rather than repletion.

New York.

A. D. ROCKWELL, M.D.

Observations on the Cretaceous at Gay Head.

SINCE my good friend Mr. David White has thought it worth while to give me a gentle reminder that I have been "a little confident and hasty in naming the various terranes at Gay Head," it seems becoming and necessary that I should offer a few short remarks in elucidation of my statements published in these columns Sept. 23, 1892, and somewhat more fully in the Transactions of the Maryland Academy of Sciences, 1892, pp. 204-212. The points of difference between Mr. White and myself are not so great as to cause questions of moment to arise from their statement. It seems evident to me that if we could visit Gay Head together for only a few hours he would not be able to resist the evidence of observation which results from clearing away the covering of the face of the bluffs. My statements were derived from an examination of the body of the hill behind the loose, or thrown, material spread upon its faces. In order to get at the beds *in place*, and which really constitute the promontory of Gay Head, it was necessary to dig away a few feet, or inches, of sand, clay, marl, and other slipped material from many parts of the face of the bluffs. This I did with the assistance of men from the neighborhood, and by this means it became possible for me to see that the axis of the whole system was a lead-colored clay, and that upon this eroded ridge of clay, which descends below lowest tide-level, all the other geological members rest in their usual nearly horizontal order of sequence, as in Maryland and New Jersey. Since my return home, I have compared this clay more thoroughly with samples from the Woodbridge and Amboy districts of New Jersey, and the conviction is pressed upon me that the two are identical, as far as regards elements and type of structure. Nevertheless, as I have not found fossils in this clay, it is not possible for me to decide as to its exact horizon. From its relative position in the column of strata, it should belong near the middle of the Alburpean formation, and therefore it should be a homologue of the dark member of the clay which occurs in the upper middle portion of the terranes at both Amboy and Woodbridge. The fact should not be forgotten that there are three distinct types of "Variegated Clay," and that these three belong to levels wide apart, and in three different formations, viz., the Potomac, the Alburpean, and the Raritan. All these become variegated by disturbance and saturation with iron-bearing waters, while in their unchanged condition they are either lead-colored or drab. The use of the term "Potomac" in the papers above cited was in deference to the usage of Messrs. McGee and Darton, but with the accumulated evidence now present to my mind it does not seem likely that the axial clay of Gay Head and Martha's Vineyard can be referred to the "Variegated Clay" of the Potomac formation as designated by Professor Fontaine and myself.

With regard to the Miocene fossils, especially the Cetacean vertebrae, settled into the broken surface of the Greensand, I did not enter into detail as to a wider distribution of these remains. It was not necessary for me to open out another series of observations beyond my immediate purpose. Let it suffice to say, however, that these remains are not confined to the surface of the Greensand, but that other specimens of the same were found by my own efforts at various points beyond this section of the bluffs.

I cannot admit that "each season presents new phases and unsettled local stratigraphic complications" in more than a superficial sense. The body of the promontory is not broken up, although every storm does abstract from or disturb a part of its face. Photographs in my possession show various changes which have been made from time to time in the ends and sides of the beds there exposed, but not a dislocation of the main body of the ridge. They confirm also the observation that several buttresses of the "Raritan" resting upon the lead-colored clay extend outward in original order from the ridge, while the intervening ones flanking the gullies are built of overthrown strata.

The so-called faulting is of a type common to clayey and sandy terranes, such as we are familiar with in the tide-water region of Maryland, where atmospheric agents, especially frost and thawing, open cracks somewhat parallel to the brow of a bluff. These cracks gape wider and extend deeper as the power of the sun increases, and at length cause a down-slide or fall when the beds become weakened by saturation with rain-water. Such fissures are also opened more widely and deeply by the dropping into them of coarse sand and pebbles, which spread apart by freezing and thawing. A notable example of this kind occurred to my observation on the projection of a heavy body of massive granite on Jones's branch, near Baltimore, where a fissure caused by freezing and thawing was gradually opened by an influx of sand, but which burst apart with almost explosive force one afternoon in the spring, following a season when numerous quartz pebbles had fallen into the crack from the overlying soil. The same phenomenon may be seen in the broken masses of granite which occur in places along the shores of Fisher's Island, near New London, Conn.

Several years ago, when many of the trees had been cleared from the brow of the cliffs of Potomac clay, along the shores of the Patapsco River, fissuring took place at intervals near the borders of these hills, and downthrows from the front of the bluffs were of common occurrence. In connection with such movements, and especially following a season of heavy autumnal rains, large cavities were rent in the cracking clays, some of which were large enough to admit a moderately large boy.

An example of the Gay-Head type of slipping, crushing, and swelling out, on a somewhat smaller scale, may be seen adjoining Sullivan's Cove, at the north-western end of Round Bay, Severn River, Md., and several of the same features, on a grand scale, may be studied next the face of Maulden's ridge, on the North-east River, Md.

The type of cutting and downthrow of the bluffs on the Vineyard Sound side of Gay Head is far more complex and varied than that of the south-west, or Atlantic, side. On the former the diagonal stroke of a surf from the south-east would cut deeper than the straight forward blow of the Atlantic on the south shore, and accordingly would be more effective in undermining the face of the terrane. The effects of those two methods of erosion are well shown on the opposite sides of this coast.

With regard to the aggregation of the non-marine lower portion of this series of formations, it seems probable that they were begun in the rocky hollows along the whole Atlantic coast from Maine to Cape Hatteras; that rapid currents carried large accumulations of broken stone and the elements of the crystalline rocks many miles out into a shallow sea, which was later barred out by the thick accumulations of these deposits, that thus a series of almost closed sounds was connected with the border of the continent, and that these sounds, extending in a sinuous north-east line, were the places of deposition of all the beds and strata which we now recognize as the Potomac, Albirupian, and the Raritan formations.

It has been my pleasure to read carefully both of Professor

Shaler's accounts of Gay Head, and to recognize the many good statements that he has made regarding particular features of the region; but I fail to see that he has given an adequate account of the real structure of the promontory, of its relations to other parts of the island, or of its relations to the similar deposits in Massachusetts, Rhode Island, and Long Island. P. R. UHLER.

Baltimore, Md., Dec. 19.

The Reticulated Structure of Protoplasm.

AFTER I had read the proof of the article on the reticulated structure of human red blood-corpuscles published in *Science* for Sept. 16, 1892, I received a book recently issued in Paris, and entitled "La Cellule Animale, sa Structure et sa Vie, Étude Biologique et Pratique, par Joannes Chatin, Professeur adjoint à la Faculté des Sciences de Paris, Chargé du Cours d'Histologie à la Sorbonne, Membre de l'Académie de Médecine." In this delightful treatise, which brings the knowledge of the animal cell to the present time, there are one or two statements in regard to the structure of protoplasm which I should have liked to quote in the paper mentioned, but as that is now impossible, I have asked the editor kindly to allow me to call attention to the following:—

C'est seulement en 1880, à la suite des recherches de Heitzmann, de Fromann et surtout des publications de Hanstein, que l'on commence à modifier la conception générale du protoplasma, pour le considérer, non plus comme une masse indifférente, mais comme une substance structurée.

Cette interprétation recontra une assez vive opposition. Il est des esprits scientifiques qui tiennent à demeurer constamment fidèles aux principes dont ils se sont inspirés dès leurs premières études et qu'ils ne consentent que difficilement à abandonner. . . .

On doit distinguer dans le protoplasma deux parties: l'*hyaloplasma* et le *paraplasma* (Fig. 49).

L'*hyaloplasma* est une substance fibrillaire, hyaline, réfringente, formant un réseau au milieu d'une substance fluide, moins réfringente, qui est le *paraplasma*. Qu'on se représente une éponge à travées très ténues et contractiles, plongée dans une substance visqueuse et granulée qui remplirait ses cavités. Cette comparaison donne une idée grossière, mais assez exacte, de la masse protoplasmique prise dans son ensemble.

Elle paraît homogène si les mailles de l'*hyaloplasma* sont uniformes et qu'on fasse usage d'un faible grossissement. C'est ainsi que le protoplasma avait été étudié durant longtemps, et l'on s'explique d'autant mieux l'erreur dans laquelle on demeurait à l'égard de ses parties constitutives, qu'elles ne se distinguent en général qu'après l'intervention de certains réactifs comme l'acide osmique. Cependant l'histologie zoologique permet de les observer directement, et j'ai déjà eu l'occasion de mentionner à cet égard l'exemple des cellules glandulaires de la Testacelle.

La structure réticulée du protoplasma s'observe dans les cellules amiboïdes comme dans les éléments à forme définie; l'étude des globules sanguins des Invertébrés (Vers, Crustacés, etc.), permet de constater aisément ce fait, d'abord révoqué en doute par des observateurs qui limitaient leurs recherches aux éléments de quelques animaux supérieurs.

ALFRED C. STOKES.

Trenton, New Jersey.

Auroral Displays.

In answer to Professor Swift's inquiry in *Science* of Dec. 9, I will say that I saw "that memorable spectacle" in the winter of 1834 or 5 when "the snow and the sky suddenly assumed," in the evening, "a bright crimson red." It is one of the most distinct things in my remembrance. I was then well along in my "teens," but had not then undertaken very extensive meteorologic observations and records.

When Dr. Swift speaks of the aurora of July 16 last as "the grandest auroral display of the century," does he take into account the great aurora of August, perhaps, in 1859, when the whole sky was covered with beautifully colored streamers? A fine corona appeared, the display lasted from evening until morning twilight, was repeated less brilliantly during the following night, and with intermediate disturbances of the telegraph lines and of the mag-

netic instruments through the day. This great magnetic storm exhibited, if I am not mistaken, its phenomena in the southern, in the northern, in the eastern, as well as in the western, hemispheres. I watched the display for most of the two nights at West Springfield, Mass., and read many notices of it in the public prints.

I will add that at 10.45 P.M., Dec. 5, 1892, I saw, to me, an unique phenomenon. The moon was shining brightly, when diverging bands from the horizon in the north-north-west spread at the zenith 60° wide and converged again at the horizon in the south-south-east. They were like thin clouds, through which the stars were easily seen. The belt of Orion was exactly then in their midst. I can liken their shapes to nothing more than the vibrations of a cord, stretched from horizon, over the zenith, to horizon again. But they were stationary, and had so far disappeared at 11.30 P.M., standard time, that only curious traces and patches remained. I fancy that had not the moon been shining, these beautiful bands would have shown luminosity.

I judged that the radiating point in the north-north-west was a trifle west of the magnetic meridian there; but our western declination here is some nine degrees. These were, of course, parallel bands, the divergence and convergence points being the effect of perspective.

JAMES HYATT.

Honeymeadbrook Station, N.Y., Dec. 19.

Alleged Extinction of Mulatto.

A FEW months since an article appeared in a medical journal affirming that the *pure mulatto* colonies of southern Ohio were dying out after the fourth generation. Can any reader point me to the article in question, or to any *definite* information bearing on the permanence of the mulatto as a species (or variety)?

Polytechnic Society, Louisville, Ky.

JAS. LEWIS HOWE.

BOOK-REVIEWS.

Lessons in Elementary Mechanics. By Sir PHILIP MAGNUS. New York, Longmans, Green, & Co., 1892. 370 p. 12°.

Elementary Manual of Applied Mechanics. By ANDREW JAMIESON. London, Griffin & Co. 265 p. 12°. \$1.25.

THESE two little treatises on mechanics illustrate two very distinct lines of college and school work, and are each characteristic of its class. Sir Philip Magnus has been distinguished for many years for his success as an author in this field, and his "lessons" have gone to their thirtieth thousand. The method of treatment of the subject is that which has been endorsed by authority and become "standard." The usual division of the subject into kinematics and dynamics is observed; and the latter is again subdivided, as customary, into kinetics and statics. Motion, as a more elementary idea than force, is first discussed, then follows the study of force and its effects in the production of equilibrium. The study of kinetics and of statics brings out the differences in effect when the body is free to move and when the forces produce no motion. The special feature of the book is the admirable manner in which energy is discussed and its operation illustrated. The extent of the work is such as is expected to suit the wants of the scholar of the first year, and is well adapted to the needs of those proposing to take the London University course or other of similar character. For this country it will make an excellent high-school course.

Professor Jamieson's work is characterized by its constant utilization of the principles taught, by application in the problems of every-day life and of constructive work. Even its illustrations have the advantage of being selected from among those of builders of machinery illustrating the principles treated. It is intended to meet the needs of students preparing for science and art examinations; but should be found of special value to those proposing to enter upon a course of technical education. It would be an admirable work for the better class of manual training schools, from which students pass into the technical colleges and professional schools of engineering. This establishment of a close relation between the principles taught and their useful applications in industry, and in the design and construction of machines,

is a matter in which the older text-books have utterly failed, but in which the author uniting a knowledge of principles with familiarity with practice may always succeed, and with great advantage to himself in competition with the teachers of the abstractions alone. Even the average practitioner would be none the worse for a careful review of this little primer of mechanics.

The best of books have their little defects; and we observe, in both these primers of mechanics, the old, and long-ago exploded, ideas on friction; no distinction being made between the laws of solid and those of fluid friction and the "mediate" friction of lubricated surfaces. Here are the old laws and the actual fact in "parallel column":—

Laws of Friction.

Solid (Jamieson and others).	Fluid.	Mediate.
(1) F varies as Pressure.	F is constant with P varying.	F varies as $f(P)$.
(2) F independent of Areas.	F varies as A .	F varies as $f(A)$.
(3) F independent of Velocity.	F varies as V^2 .	F varies as $f(V)$.

The first of these sets of "laws" is that usually found unqualified in elementary text-books and is, obviously, entirely misleading; although defective lubrication is so common in machinery that the result is less serious than might otherwise be the fact.

Geodesy (Riverside Science Series). By J. HOWARD GORE. Boston, Houghton, Mifflin & Co. 218 p. 16°. \$1.25.

Introduction to Geodetic Surveying. By MANSFIELD MERRIMAN. New York, J. Wiley & Sons. 170 p. 8°.

THE first of these books is an historical account of the science of geodesy from the time of the ancients to the present, written in popular and interesting style, and is likely to prove most acceptable to the average reader, not an expert, who may desire to know something of the methods which have been adopted in the determination of the dimensions of the earth and their results. Its author has enjoyed the rare privilege of working from the original documents, as he states in his preface, and his sketch thus comes as authoritative. He commences his task by reference to, and brief descriptions of, the primitive notions of the older peoples, and their rude attempts to measure the earth. When their comparative ignorance of the subject, and their lack of instruments of exact measurement are considered, their approximations to the actual value of these dimensions seem little less than marvellous. The Chaldeans not only knew the earth to be "round" but made the degree equal to 4,000 steps of a camel, and the circumference of the earth about 24,000 miles. The Greeks and Romans took this quantity to be 250,000 stadia; the Arabians found it to be between 56 and 57 miles, 71 of our miles, per degree. Fernel, a French geometer of about 1550, measured the degree, and made it about 69 miles. Snell, in 1615, made the first scientific measurement of importance, however, making the arc of a meridian 55,072 toises, which is about 2,000 toises short. The toise is 6.4 feet.

Picard, in 1670, made the degree 57,060 toises, and so nearly correctly as to give to Newton his famous proof of the extension of the gravitation of the earth to its satellite. Later work is familiar to all interested in the subject, and it is a pleasure to note that the U. S. Coast Survey has done its share. It is considered by Professor Gore that the computations of Professor Harkness, making the ellipticity of the earth 1:300.2, and the quadrant to measure 10,001,816 meters, will prove most exact, although those of Bessel and Clarke are now generally received.

Professor Merriman's work is a formal and scientific treatise on the work of geodetic surveying. It includes a number of lectures on the figure of the earth, prepared as introductory, and also a discussion of the "Method of Least Squares," written especially for surveyors and engineers, as well as for students. The third and concluding part contains a synopsis of the methods and computations of precise triangulation. The introductory portion gives a history of the development of modern methods and some interesting facts relative to the work of the older geometers and

surveyors. The treatise is a most satisfactory one for its purpose; its author is known as not only an authority and in all respects competent, but as one of the most accurate and painstaking of writers. His work will undoubtedly find its place promptly, and will be adapted for purposes of instruction in many schools of the higher class, and will supply multitudes of young engineers with the facts and methods that they require in their practice.

Coals and Cokes in West Virginia: a handbook on the coals and cokes of the Great Kanawha, New River, Flat Top and adjacent districts in West Virginia. By WM. SEYMOUR EDWARDS. Cincinnati, R. Clarke & Co. 162 p.

MR. SEYMOUR has collected in this book a great mass of statistical and geological information which cannot fail to be useful and valuable to all who are interested in the West Virginia coal-fields. In the first chapter a brief review is given of the coal-measures as they occur in the southern part of the State, and this is followed by chapters giving details of numerous sections. We have first tables of vertical sections giving the name used by the Pennsylvania Survey, the local name, height or thickness, material, etc.; then tables of chemical analyses, tables showing comparative gas-yielding power, steam-producing power, and chemical analyses and physical tests of coke. This closes part one.

In part two we have sketches of various districts and tables showing the output, cost of production, transportation, and average prices obtained in a series of years. In these days of pools and combines by railroads, and of trusts by manufacturers, it is of interest to note the immense difference in cost of transportation when water and land carriage is considered. The Great Kanawha River has been improved under the auspices of the general government by means of locks and dams so as to afford continuous transportation facilities for about ten months out of the year. The most of the dams in the river are "movable," that is, can be lowered to the bottom of the stream in high water and raised when the river falls, so as to afford a constant depth of six feet.

The coal is carried in barges averaging about 500 tons, or between 12,000 and 13,000 bushels. Four barges can be easily handled by a tow-boat in the locks, and from 4 to 14 in the open river; while on the Ohio from 14 to 34 barges are taken by a single tug. Thirty barges contain about 15,000 tons, equal to a continuous train of 20-ton railroad cars $5\frac{1}{2}$ miles long. The rate of towing this coal from Charleston, W. Va., to Cincinnati, a distance of 263 miles, is only 25 cents per ton, or, to those who hire barges and so pay rent for them, $37\frac{1}{2}$ cents per ton. To Louisville, 394 miles from Charleston, the rate, including rent, and the return of barges, is 48 cents per ton, or $1\frac{3}{10}$ mills per ton per mile. For the longer distance to New Orleans, 1,776 miles, the cost is \$1.25 per ton, or $\frac{1}{12}$ of a cent per ton per mile. Contrast this now with the cost of railroad freight from New York to Chicago, 913 miles, and we have \$4.50 per ton, or 5 mills per ton per mile, against $\frac{7}{10}$ of a mill per ton per mile for 1,776 miles to New Orleans. Surely nothing can show more clearly the value of water carriage to the community as a whole, and no better argument could be advanced in favor of the continued development of our river, canal, and lake navigation.

JOSEPH F. JAMES.

Washington, D.C., Dec. 10.

A Manual of Physics. By WILLIAM PEDDIE, D.Sc., F.R.S.E. New York, G. P. Putnam's Sons. 501 p. 8°.

THE language of mathematics is noted for precision and conciseness; but, with its incomparable advantages, both for expression and for reasoning, it offers a barrier to many minds as forbidding as any Chinese wall. One reader of physics enjoys brilliant lecture experiments, another desires a guide to accurate laboratory measurements, but neither phase is apparent in this volume. It is offered as "an introduction to the study of physical science, designed for the use of university students." With little description of apparatus or manipulation, it presents an orderly view of the several topics, setting forth the unity of natural philosophy, and tracing the results of observation to the kinetic

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

Dec. 20.—Symposium, Is Simplified Spelling Feasible? Discussion by Professor F. A. March of Lafayette College, Hon. A. R. Spofford, Hon. Wm. T. Harris, Hon. Edwin Willits. The discussion will be continued Dec. 27 by the remaining speakers.

Reading Matter Notices.

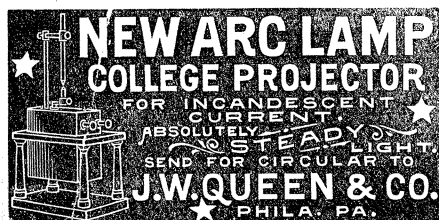
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SCIENCE TENTH YEAR.

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hypotheses which best explain them. The more important formulas of differential and integral calculus are deduced in an early chapter (of only 15 pages) on "varying quantities." This is well written for review, but less adapted to the student who is unfamiliar with calculus. The next chapter discusses vectors, composition of motion or velocities, harmonic motion, etc., as preliminary to mechanics, gravitation, and the properties of matter. While the phenomena and the laws of sound, light, heat, and electricity are taken up in succession, the essential unity and interdependence of the several subjects are kept in view. Thus many of the terms and formulas which we usually associate with statical electricity are discussed in connection with gravitation.

Among the interesting topics are Thomson's hypothesis of vortex atoms, Maxwell's electro-magnetic theory of light, and the several theories of ether.

References to original papers, and problems to be solved by the student, might have been desirable features, but would have increased the size of the volume. A very large range of physical science is comprised within moderate space; and this is confidently recommended to those who enter into the beauties of mathematical thought.

ROBT. B. WARDER.

The Woodworkers' Manual. By C. R. TOMPKINS, M.E. The author, Dover, N.H.

THIS is a pamphlet of sixty pages containing a condensed account of the machinery and processes of woodworking, by an author evidently practically familiar with the subject. He gives a plain and simple account of the best practical methods of planning and building the woodworking "plant" and of placing its machinery. The most usual and standard forms of woodworking machinery are described, and "practical instructions for the care, management, and preservation of the machinery" are given. Illustrations of the tools employed are also given. The paper is printed in good style, and it would be worth while, one would think, to double its extent and bind it up. The good sense of the author is seen in his remarks about the use of lubricants.

He thinks that there is "no economy in saving five dollars on the price of a barrel of oil, and losing ten dollars, in consequence of its use, in extra repairs; which is in most cases a fact."

AMONG THE PUBLISHERS.

PROFESSOR E. A. SMITH, State Geologist of Alabama, has recently published a "Sketch of the Geology of Alabama." In it are given descriptions of the various geological formations outcropping, with mention of the economic products found in them. In this regard the most valuable rocks are the crystalline schists of Archæan age, and the Coal Measures. From the former are derived many varieties of minerals and from the latter large amounts of coal. The Clinton or Red Mountain formation is also of value for the large quantity of iron ore it contains. The formations occurring in the State and treated of with more or less fullness, are Archæan, Cambrian, Silurian, Devonian, Carboniferous, Cretaceous, Eocene, Miocene, Pliocene (?), Pleistocene, and Recent. The pamphlet will prove useful to geologists in general and the citizens of Alabama in particular.

—Professor Merwin-Marie Snell, who is one of the few specialists in comparative religion to be found in the United States, and who has been known for some years as a writer and lecturer on that and other anthropological subjects, has recently severed his connection with the University at Washington, for the purpose of giving his attention to the conducting of a magazine devoted to the comparative history of religions and the archæology, philology, history, philosophy, religion, and literature of the Asiatic peoples. The leading specialists of Europe and America will be found among the contributors, but it is intended to give the periodical enough of a popular character to make it acceptable to the general reader as well as to the serious students of the sciences concerned. The name of the magazine will be *The Oriental Review*. It will be a bi-monthly, with a subscription price of two dollars a year. The publication office is at 2,128 H Street, N. W., Washington, D. C.

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For sale or suitable exchange.—A spectrometer made by Fauth & Co., Washington, D. C., according to the plan of Prof. C. A. Young. This instrument is suitable for the most advanced investigations and determinations. Cost originally \$700 and has been used but little. Will be disposed of at a considerable reduction. Address Department of Physics, Ohio University, Athens, O.

I will send British land and fresh-water shells in return for those of America, any part, sent to me. I have at present about fifty or sixty species, with many varieties. W. A. Gain, Tuxford, Newark, England.

The Biological Department of Hamline University desires to offer microscopic slides of animal tissues, or whole animals, in exchange for first-class fossils. Address correspondence to Henry L. Osborne, Hamline University, Hamline, Minn.

For sale.—A set of the *Berichte der Deutschen Chemischen Gesellschaft*, from Jan. 1, 1877, to Jan. 1, 1892, bound in twenty-six volumes to Jan. 1, 1888 and remaining four years unbound. Also the *Bulletin de la Société Chimique de Paris*, from Jan. 1, 1879, to Jan. 1, 1892, bound in eighteen volumes to Jan. 1, 1888, and remaining four years unbound. Dr. Marcus Benjamin, care of D. Appleton & Co., 1 Bond St., New York City.

For Sale.—A new Model U. S. Army Hospital Microscope (Zentmayer), also ¼-inch and 1½-inch Objectives. HENRY C. WELLS, 151 Broadway, New York.

Wants.

WANTED.—American Journal of Conchology, seven volumes. Parties having these for sale will please address the undersigned, stating condition and price. R. Ellsworth Call, Louisville, Ky.

A GRADUATE ENGINEER will give instruction evenings in geometry, trigonometry and surveying, mechanics, physics, mechanical drawing and general engineering construction. Five years' experience in field and editorial work on engineering journal. References furnished. C. S. H., 102 Tribune Building, New York.

A POSITION is desired in the South, preferably the Gulf States, where I can teach the sciences. Can also instruct in other branches. Salary only nominal, as I am simply desirous of employment while spending the winter in the South. A private family preferred, but will accept regular school work if not too confining. MORRIS GIBBS, M.D., Kalamazoo, Mich.

WANTED.—By well-qualified and experienced science master and associate of the Royal School of Mines, London, aged 26 (at present in England), a mastership in technical college or university for any of the following subjects: Engineering sciences, geology and mineralogy, physics, chemistry and metallurgy, etc., etc. Can provide excellent references and credentials. Apply, J. G., 17 Sussex St., Rochdale, England.

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The American Geologist for 1893.

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